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*THE PROTOLENUS FAUNA.**

THE above article will be one of especial interest to students of the early Paleozoic faunas, since it describes one of the oldest known.

From time to time during the last thirty or forty years discoveries of fossils have been made in the Cambrian rocks of eastern Canada. Those of the St. Lawrence valley and northern Newfoundland were by Billings referred to the 'Lower Potsdam,' but at a later date, together with others found in that valley and in southern Newfoundland, they have been more specially correlated with the Olenellus Fauna by C. D. Walcott and others.

Other fossils found in the lower part of the Cambrian rocks in New Brunswick below the Paradoxides bed were naturally at first thought to be also of this fauna, but, as will be seen by considerations advanced further on, it does not now seem possible so to establish the relationship.

The discoveries in New Brunswick have from time to time been reported in articles published by G. F. Matthew in the Transactions of the Royal Society of Canada, but such important additions were disclosed through the collections made by W. D. Matthew in 1892 and 1893, and by him in conjunction with G. van Ingen for Columbia College, New York, in 1894, that a special article on this, the Protolenus fauna, has been written. From this article the following abstract has been made of the character of the fauna, and the conclusions arrived at from its study.

The fauna consists of Foraminifera, Sponges, Molluscs and Crustaceans. All the Foraminifera described are referred to the genera *Orbulina* and *Globigerina;* the sponges include *Protospongia* and others. The molluscs are mostly hyalithoid shells of the genera *Orthotheca*, *Hyolithus* and *Diplotheca*. A remarkable mollusc having a helicoid shell and supposed to be a Heteropod, enables me to establish a new genus. The Crustaceans are chiefly of two groups, Ostracoda and Trilobita, of which the former are remarkable for the large number of genera and species, as compared with the trilobites; two predominant and characteristic genera are *Hipponicharion* and *Beyrichona*. All the trilobites are of genera peculiar to this fauna, except *Ellipsocephalus*, which, although one of the dominating types, also occurs in the Paradoxides beds of Europe. The most characteristic genus or trilobites is *Protolenus*, which is abundantly present in the typical beds.

The following are some of the salient characters of the fauna as at present known. *All the trilobites have continuous eyelobes.* This is a decidedly primitive character, and its value in this respect is shown by the genus *Paradoxides* of the overlying fauna, which began with small species having such eyelobes, and culminated in the large forms of the upper Paradoxides beds in which the eye-lobe was considerably shortened. This shortening of the eyelobe was carried still further in the *Oleni* of the Upper Cambrian, dwarfed forms, with a general similarity to the *Paradoxides*, in which the eyelobe is almost on a line with the front of the glabella.

The important family of Ptychoparidæ is absent. This family did not have continuous eyelobes, for in the young, when this projecting fold first shows itself, it is short and at the lateral margin of the head-shield. No trilobite with such an eyelobe has been found in this fauna. The Ptychoparidæ had about a dozen species in the Olenellus Fauna, and became quite common in that with Paradoxides, and continued to abound throughout the Cambrian period.

The genus Conocoryphe is absent. This is specially a type of the Lower Paradoxides

*Abstract of a paper communicated to the New York Academy of Sciences by G. F. Matthew, of St. John, N. B.

beds and under, the name of *Conocoryphe trilineata* (*Atops trilineatus*), is claimed as a characteristic fossil of the Olenellus Zone.

The genus Microdiscus is absent. This trilobite is especially characteristic of the Olenellus Zone and continued to live with Paradoxides. Here it occurs in the Paradoxides Zone, but is absent from the Protolenus Fauna.

The genus Olenellus is absent. Though carefully looked for, no example of this genus has been found among the trilobites of the Protolenus Fauna, hence, though this fauna apparently holds the place where we might naturally expect to find *Olenellus*, that genus proves to be absent, or at least not at all characteristic; and, as so many of its associate genera also are absent, *we cannot regard this fauna* as the *Fauna of Olenellus*.

Of the genera of trilobites that are present *Micmacca* has affinity with *Zacanthoides*. It differs in the course of the posterior exterior of the dorsal suture. The relation will seem closer if we suppose a movement of the eyelobe during the growth of *Zacanthoides* similar to that which occurred in the Ptychoparidæ, by which the eyelobe was drawn in toward the glabella, while at the same time there was a projection of the posterior extension of the dorsal suture outward toward the general angle. If this change were shown to have occurred in *Zacanthoides*, *Micmacca* might be looked upon as an ancestral form of that genus.

In this fauna there is a very primitive assemblage of Brachiopods, of forms which it is in many cases difficult to assign to any known genus. Many are small, some are minute, and the larger species belong to the Obolidæ and Siphonotretidæ.

The Gasteropoda have already been alluded to; among these *Pelagiella* (n. gen.) is remarkable for the peculiar aperture which seems to indicate a free swimming Heteropod.

This fauna is distinguished from that of Olenellus by two marked features; it is more *primitive* and also more *pelagic*.

The way in which the trilobites are bound together by the single feature of a continuous eyelobe shows a unity of origin and a close relationship not found in any other fauna. And yet among these trilobites there are forms which in other respects are parallel to the types which developed in the later faunas; thus in *Protolenus* we have have the flat pleura with the diagonal furrow of *Paradoxides* and the deeply grooved, geniculate pleura of *Ptychoparia*, and at the same time the prominent glabella and deep dorsal furrows of *Solenopleura*. *Micmacca*, as has already been said predicated *Zacanthoides* of a later fauna, and *Protagraulos* in its almost obliterated glabella and flat cephalic shield closely resembles *Agraulos* of the Paradoxides Fauna.

It is a more *pelagic* fauna than that of Olenellus, for we notice the absence of many forms differentiated for shore-conditions. Trilobites with fixed outer cheeks, like *Olenellus* and *Microdiscus* are absent; calcareous corals and sponges are rare; thick-shelled brachiopods and the Orthidæ are wanting, or rare; no Lamellibranch is known, but Foraminifera are quite common in some of the beds.

The question of the antiquity of this fauna as compared with that of Olenellus is discussed. The facies of the fauna as above described indicates a greater antiquity, but if the two faunas were contemporaneous, that of Olenellus may have reached these shores first.

VOLCANIC DUST IN TEXAS.

SOMETIME since the writer was given, for examination by the microscope, a sample of a white, fine-grained silicious deposit by Prof. R. T. Hill, of the U. S. Geological Survey, who writes as follows concerning it:

"The material which I gave you was collected by an old Texas friend of mine, Mr. S. P. Ford, in De-